

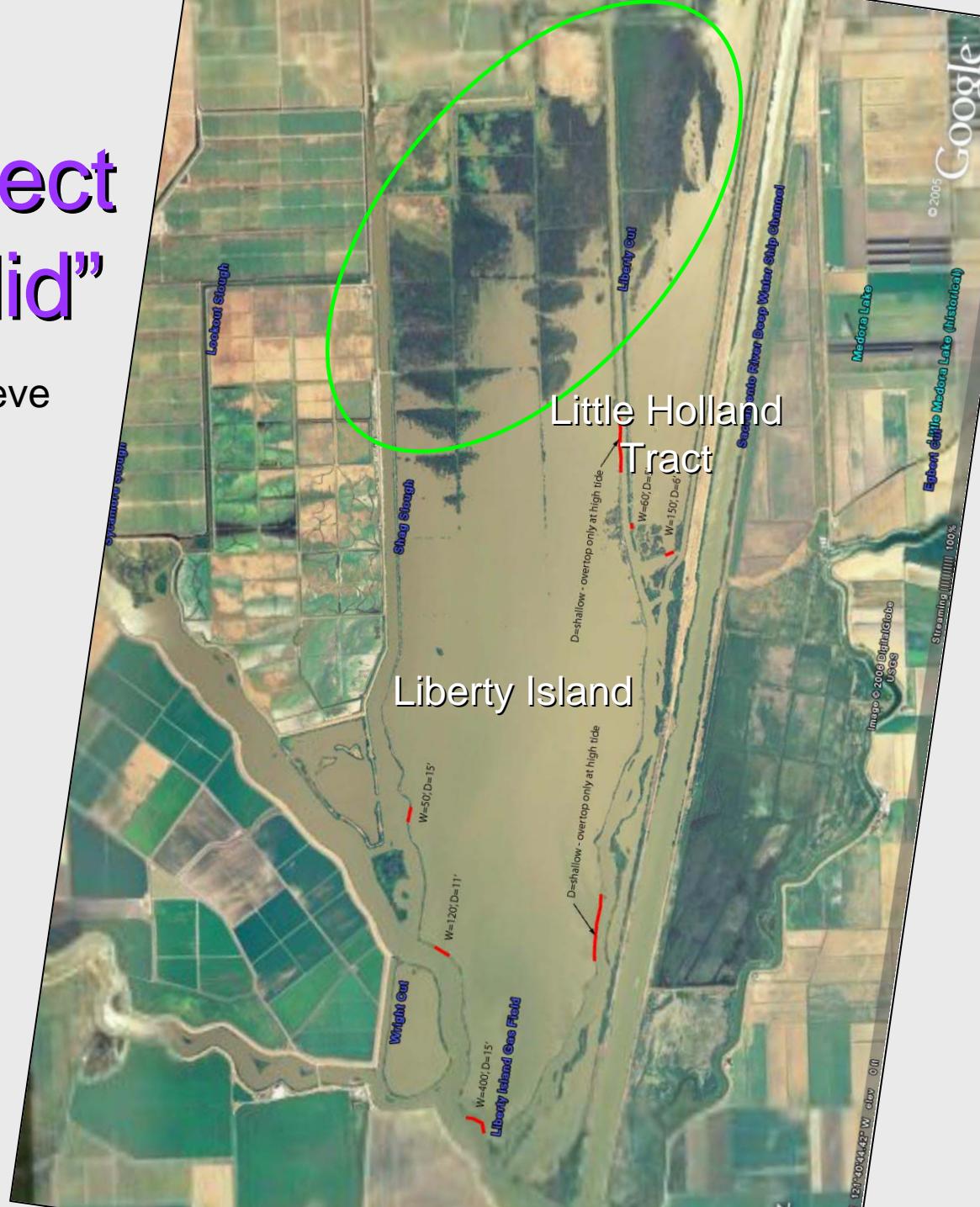
Elevation Matters: Wetland restoration where it wants to be

-- LiDAR Applications --

Chris Enright, Xiao Wang, Joel Dudas
DWR
IEP Meeting
February 28, 2007

"The best restoration project nobody ever did"

- Dr. Steve



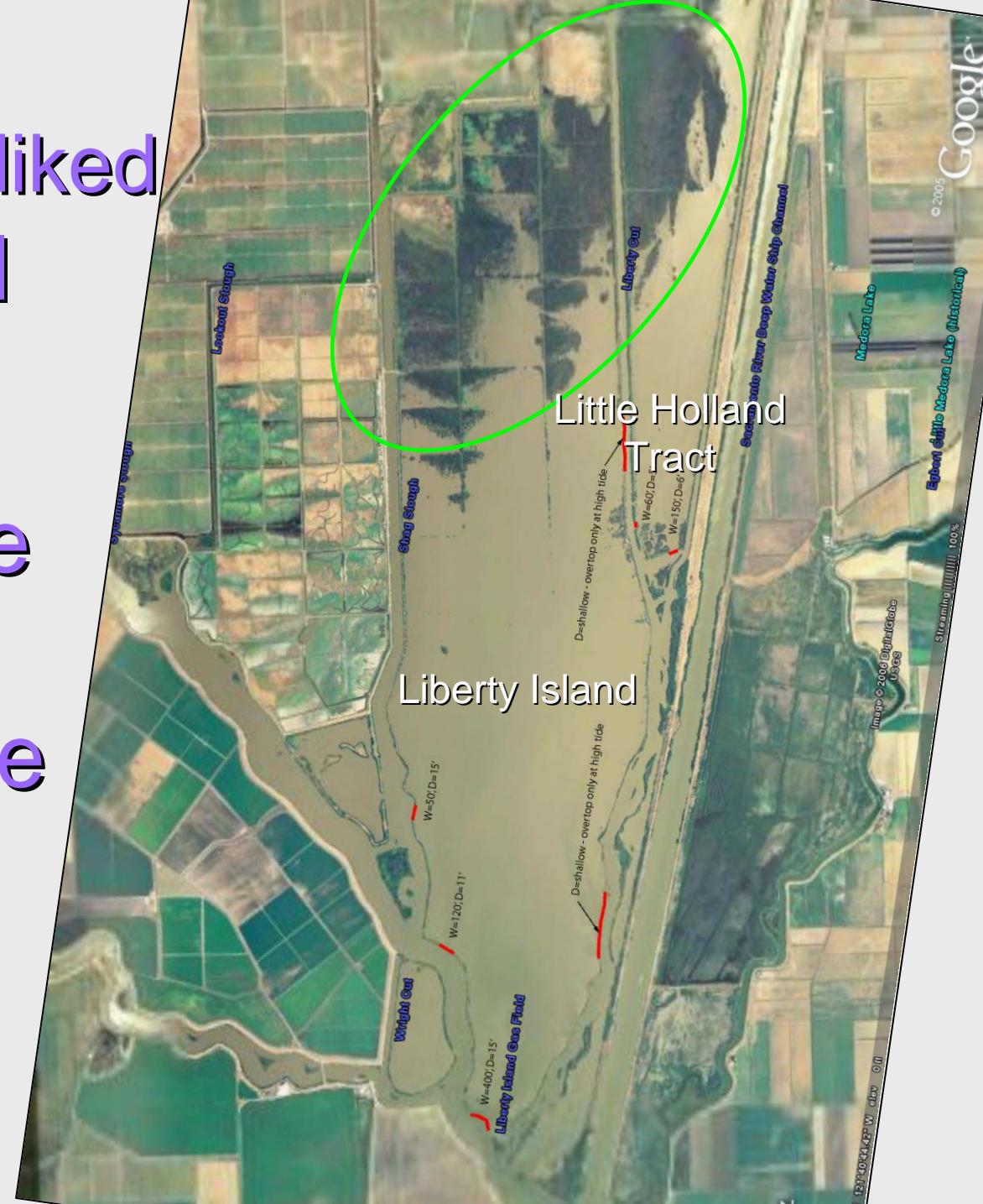
Lesson:

- Tidal Marsh happens rapidly if land elevation is intertidal.
- If it isn't, it won't.



So,

- Where is the diked landscape still intertidal?
- Where will the landscape be intertidal in the future?



LiDAR provides essential data

- Our first opportunity to see the vertical landscape as a *continuous* spatial object.
- Used carefully, it's accurate enough for TM restoration planning/visioning.
- Where are landscapes on the edge of “going Delta.”

Three LiDAR Applications

1. Where is the intertidal elevation landscape now?
2. Where will the intertidal landscape be in the future?
3. Continuous landscape modeling

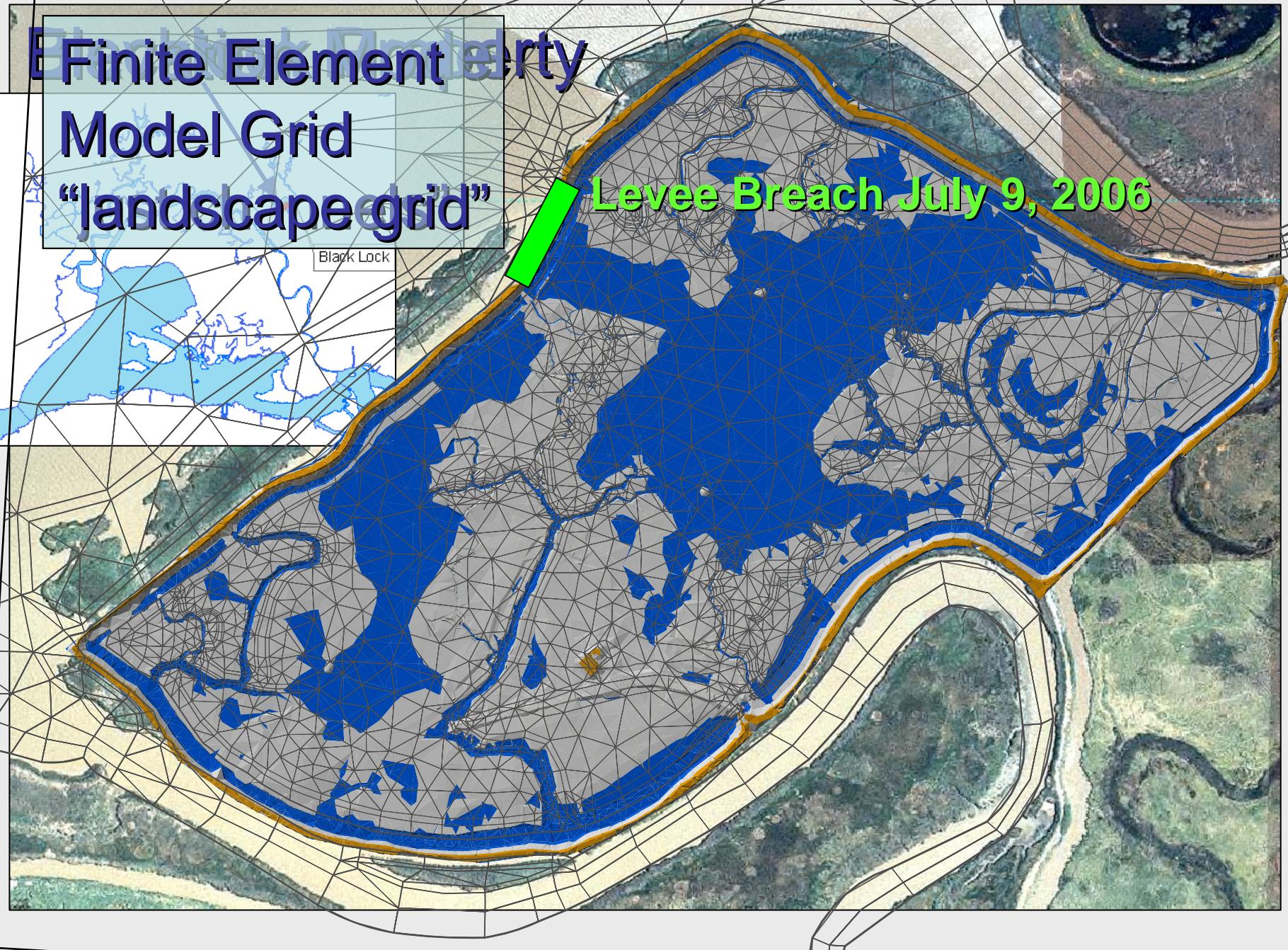
LiDAR Application 1: Continuous landscape modeling

- Suisun Marsh Plan modeling in progress.
- For example: Blacklock property...

Finite Element Model Grid “landscapegrid”

Levee Breach July 9, 2006

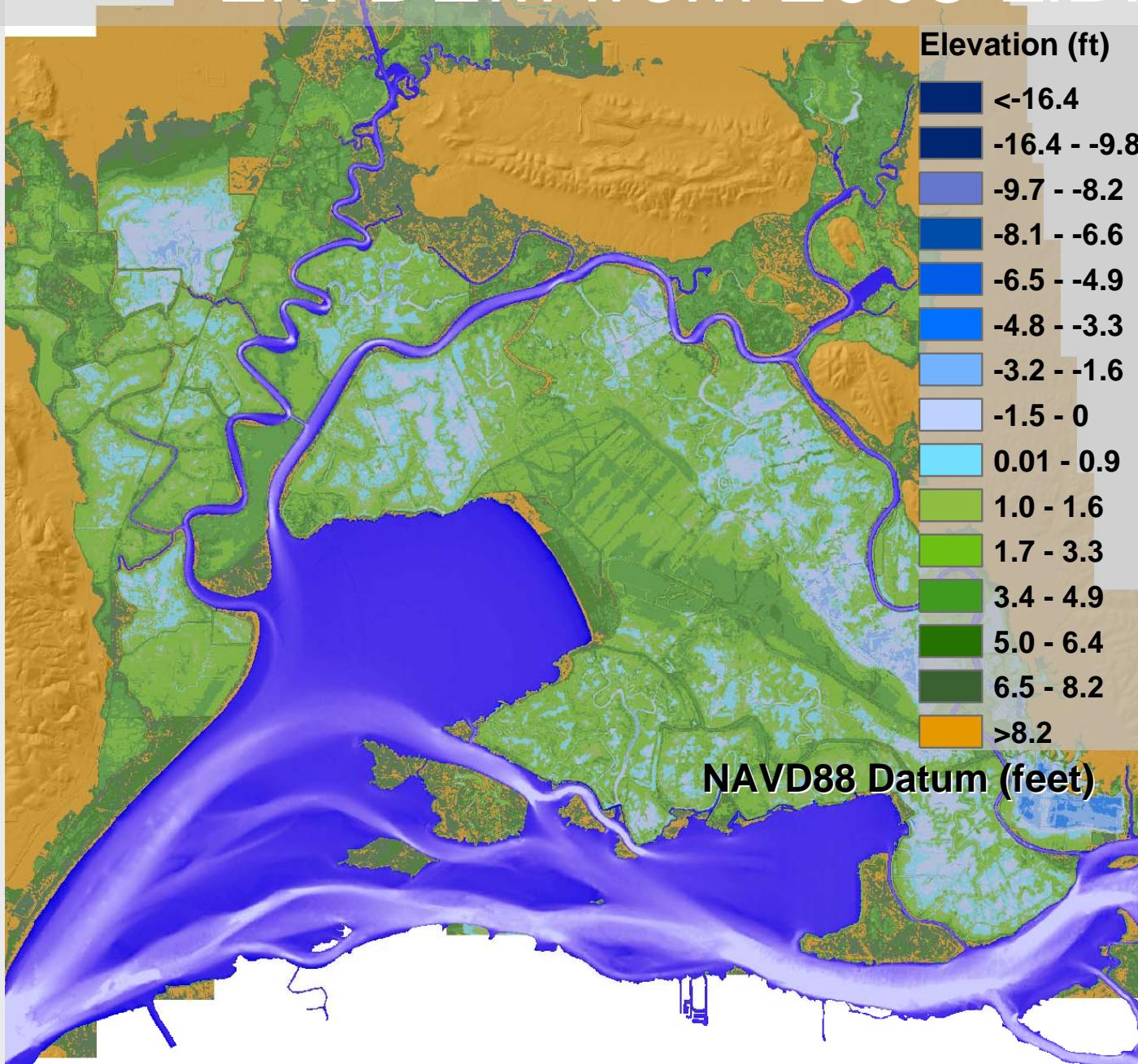
Blank Lock

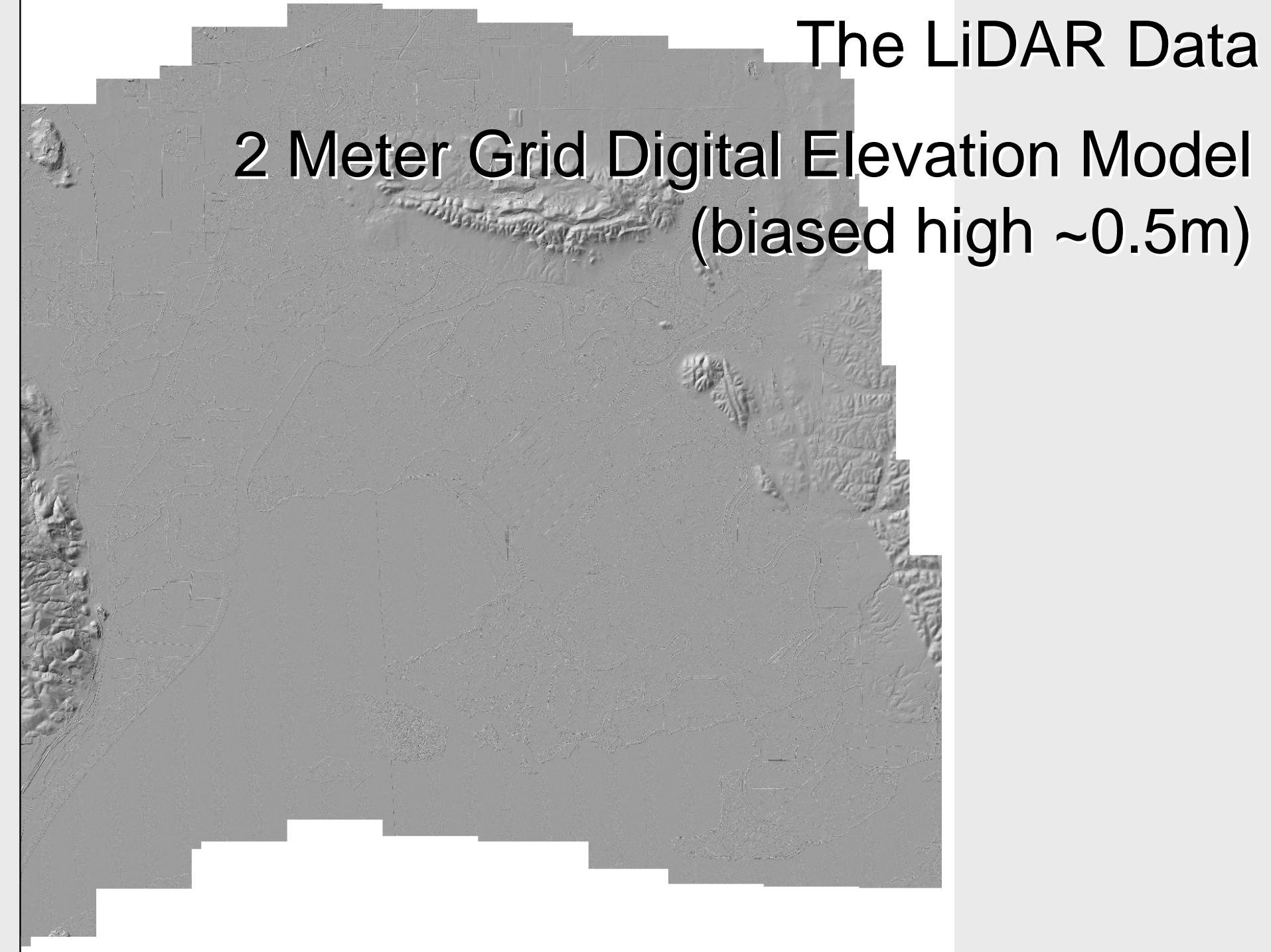




2. Where is the intertidal
landscape now?

2m DEM from 2005 LiDAR survey



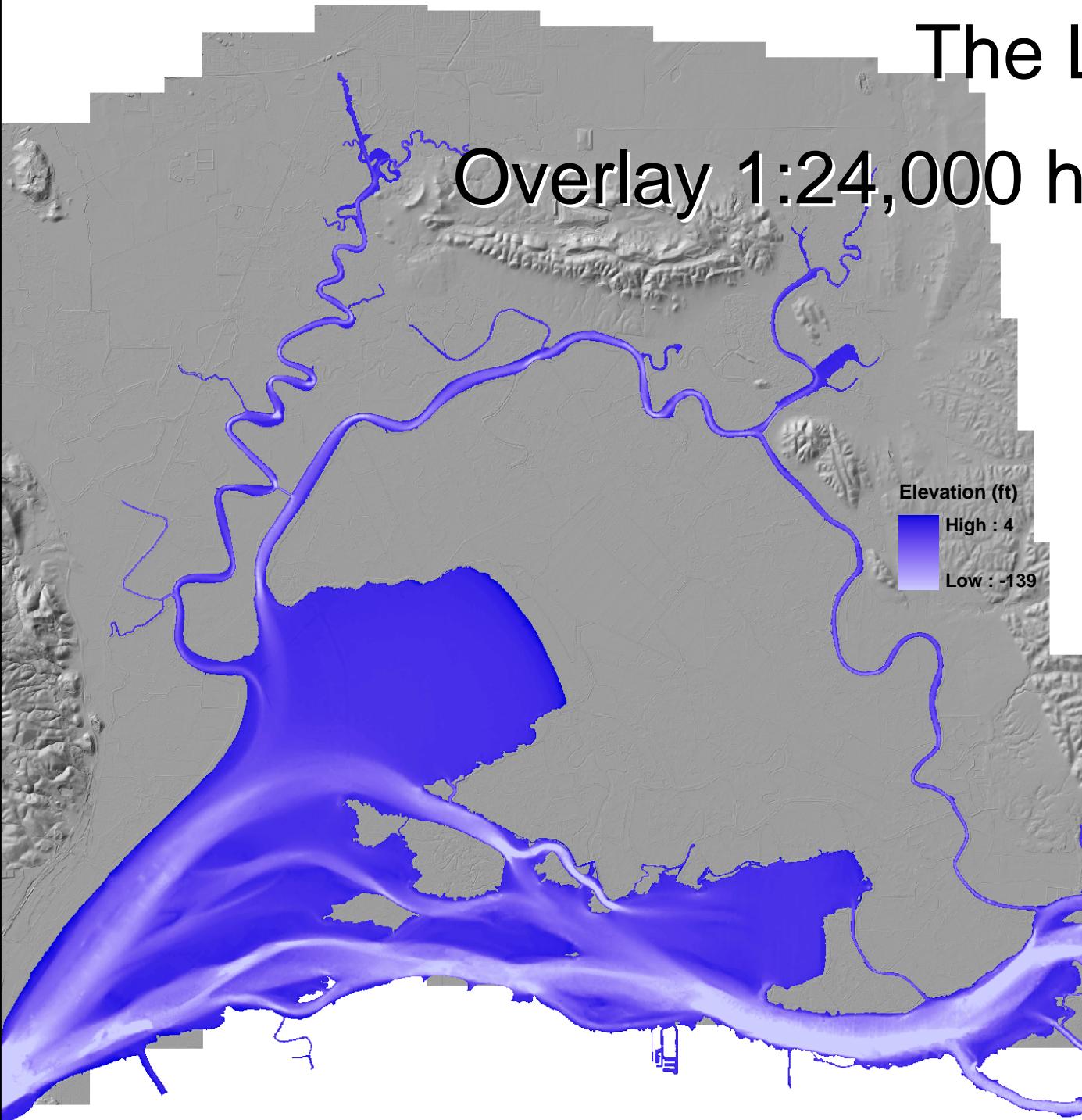


The LiDAR Data

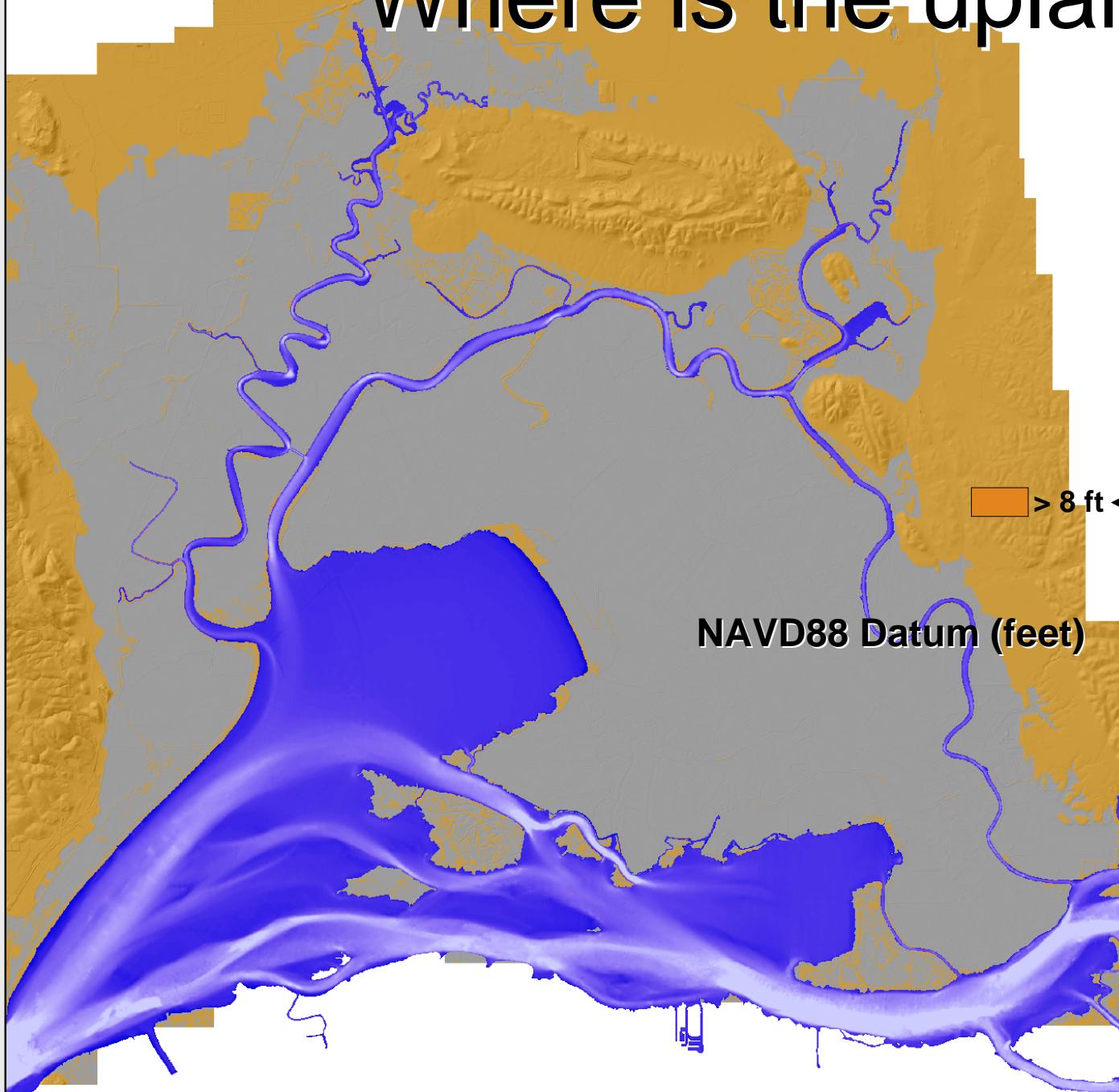
2 Meter Grid Digital Elevation Model
(biased high ~0.5m)

The LiDAR Data

Overlay 1:24,000 hydrography

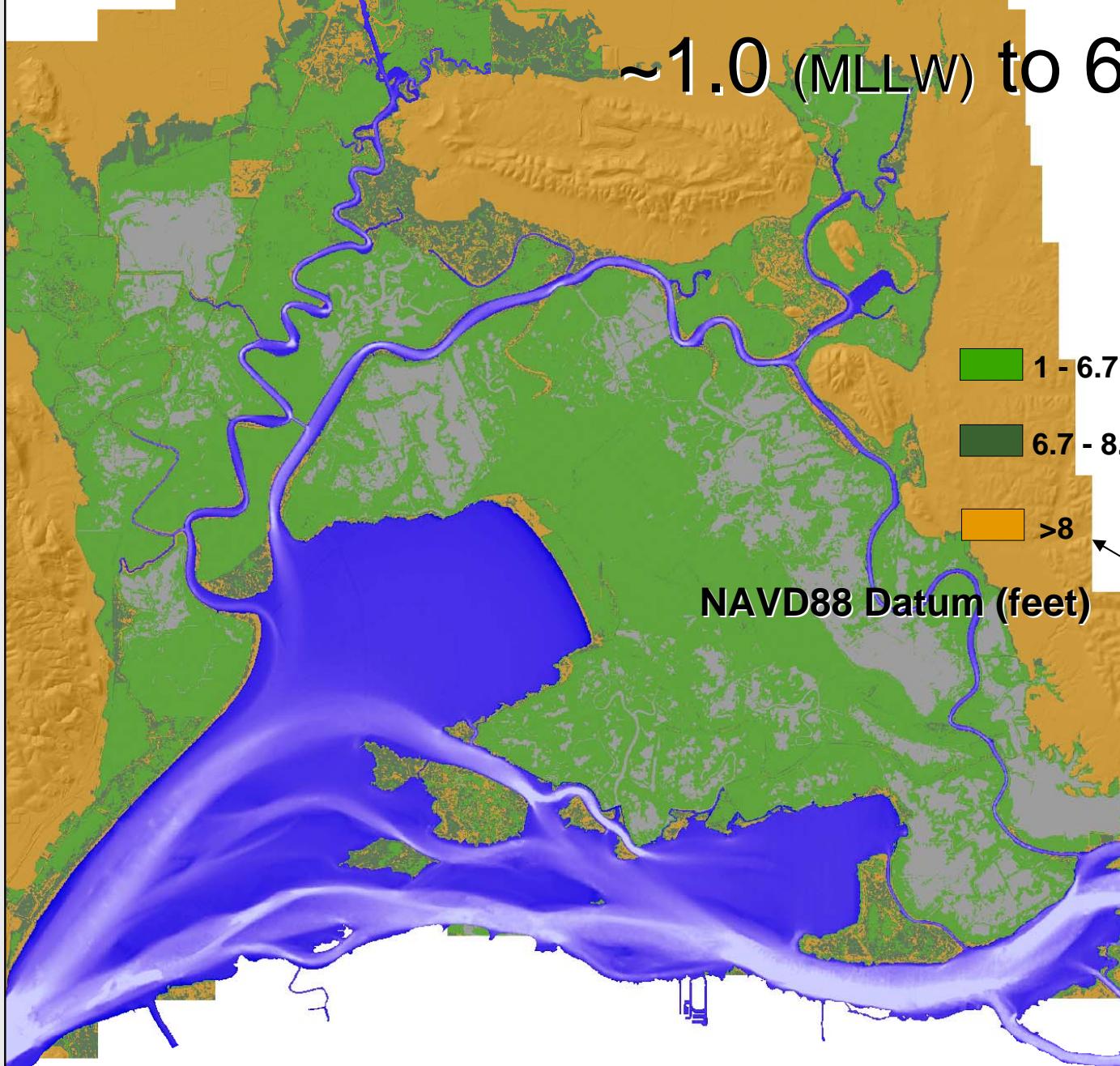


Where is the upland area? (>8 ft)



Where is the inter-tidal area?

~1.0 (MLLW) to 6.7 ft (MHHW)

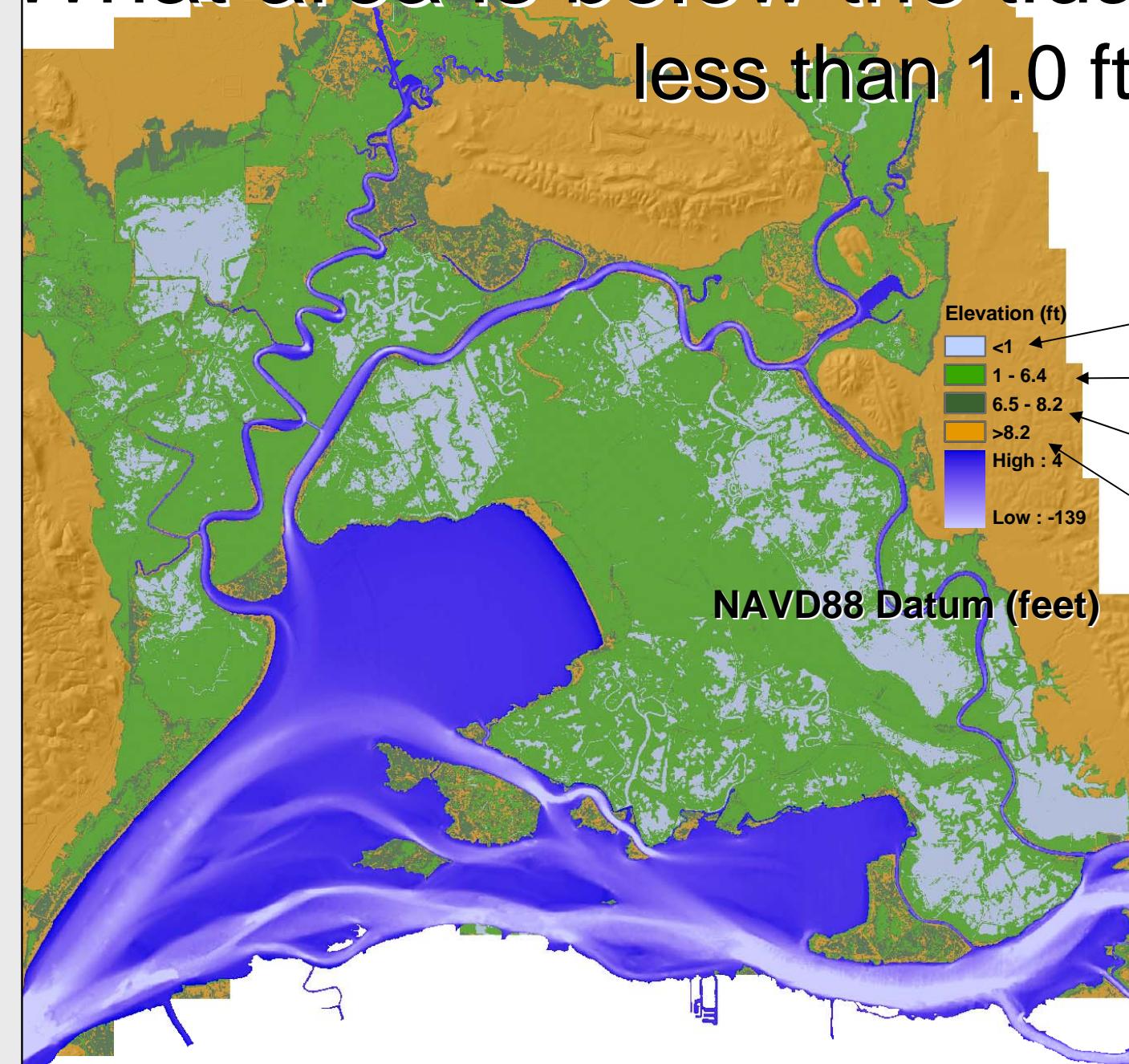


Inter-tidal
(MLLW-MHHW)

TM, and upland
transition

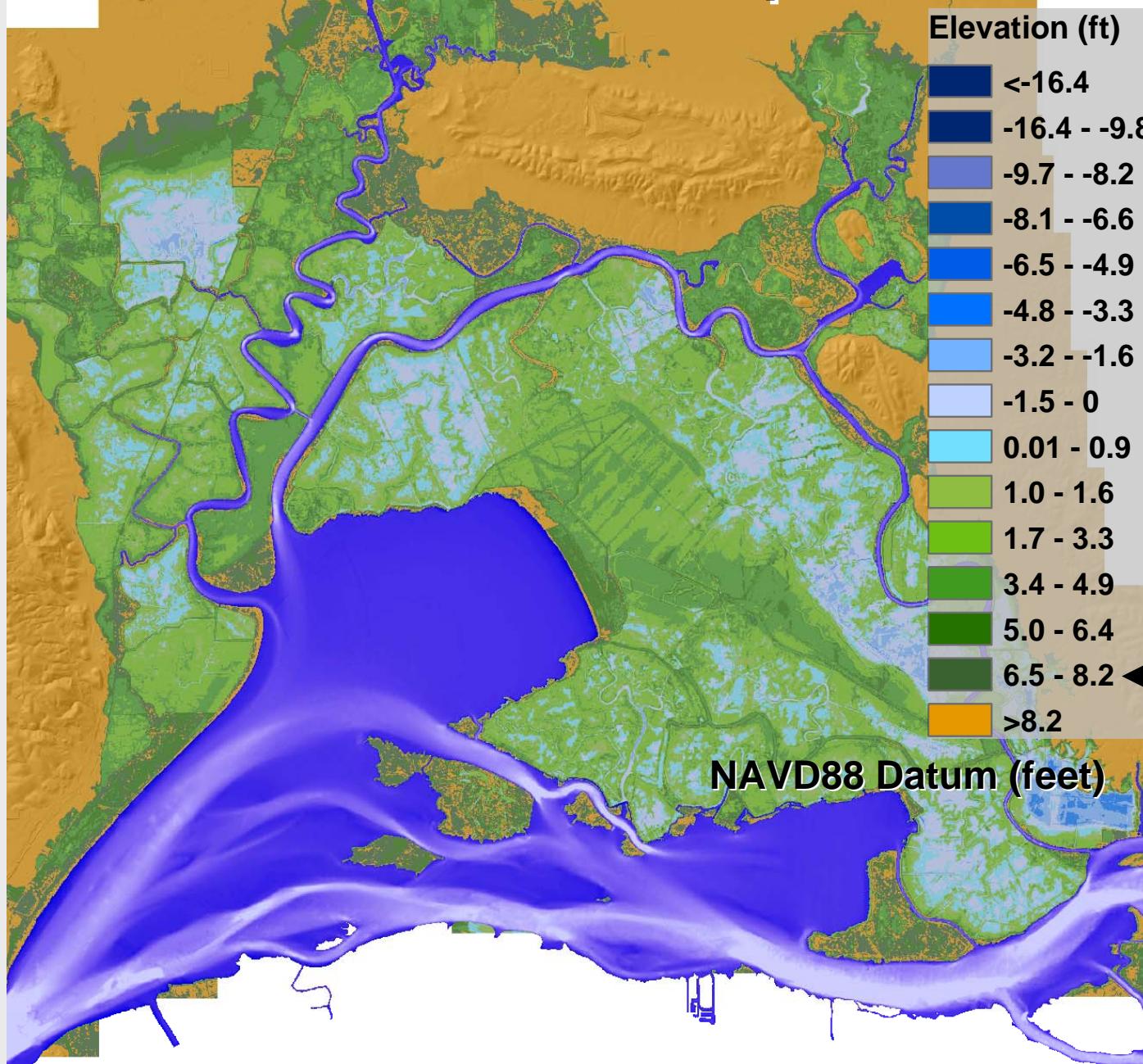
Upland

What area is below the tidal frame? less than 1.0 ft (below MLLW)



- Below MLLW
- Inter-tidal (MLLW-MHHW)
- TM, and upland tran
- Upland

Where is the “upland transition”?



Tidal Marsh
and upland
transition

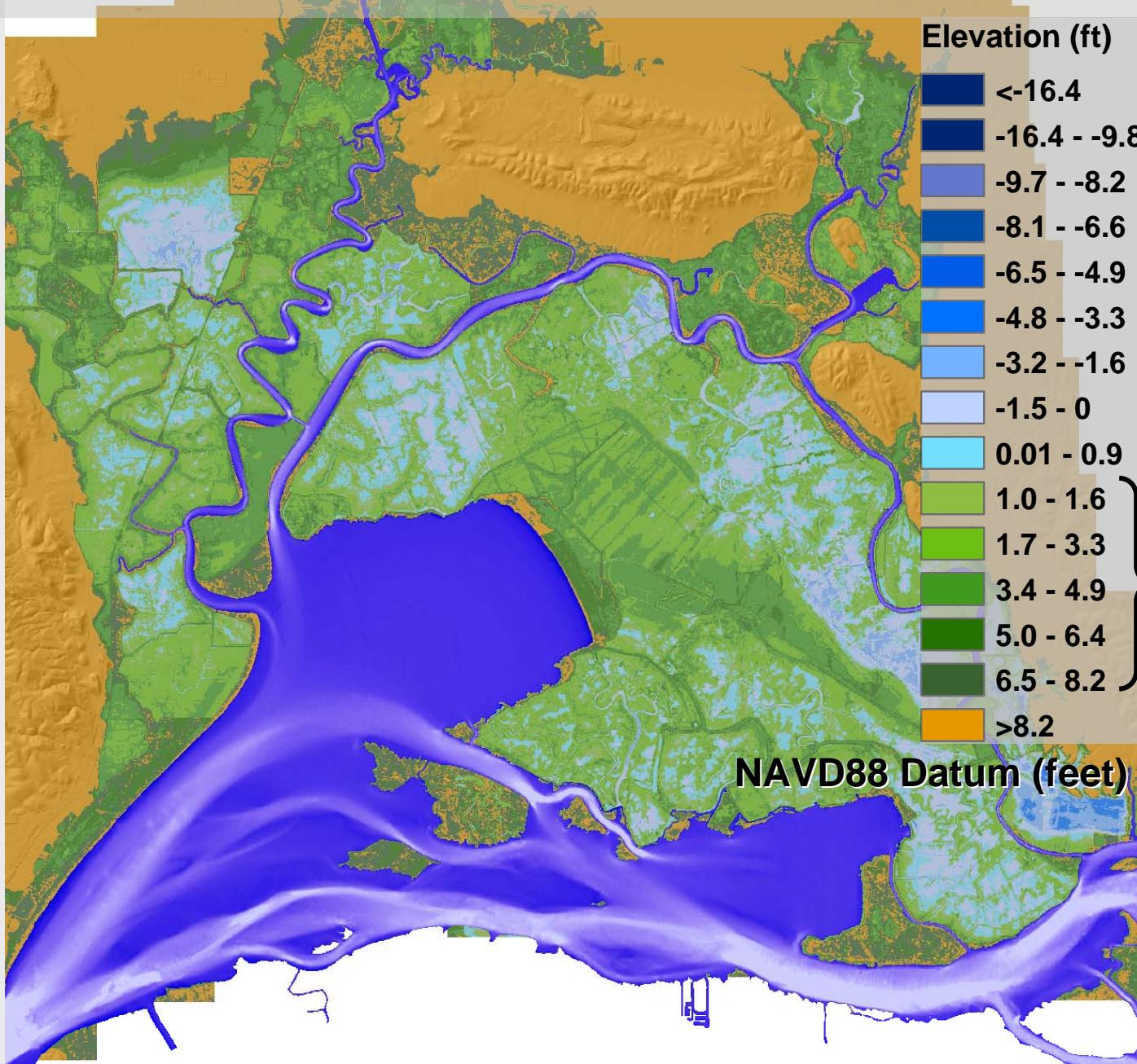
Tidal Marsh evolution depends on:

- Initial elevation of the site relative to the tidal frame.
- Sedimentation rate (slowing down)
- Tule colonization: (intertidal zone down to about 1 foot below MLLW (-Orr et al., SFEWS)).
- Tule extension by rhizome (from the perimeter is slow - about 1m/yr)
- Relative sea level rise

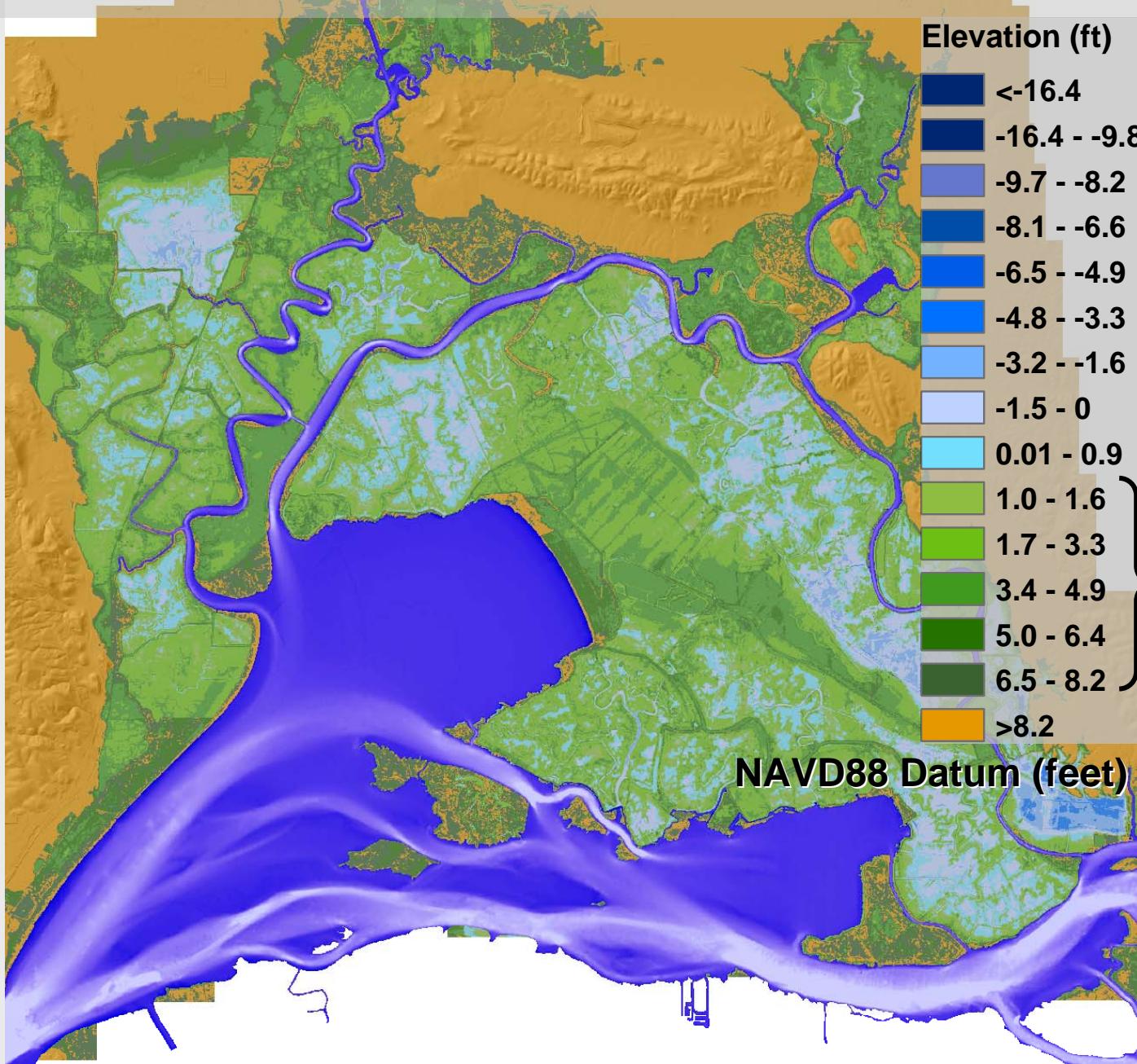
Tidal Marsh Restoration Now and in the Future

- Where are landscapes that would restore themselves to self-sustaining TM function?
 - Sea level is rising
 - Suisun Marsh is subsiding

TM Restoration Site Selection

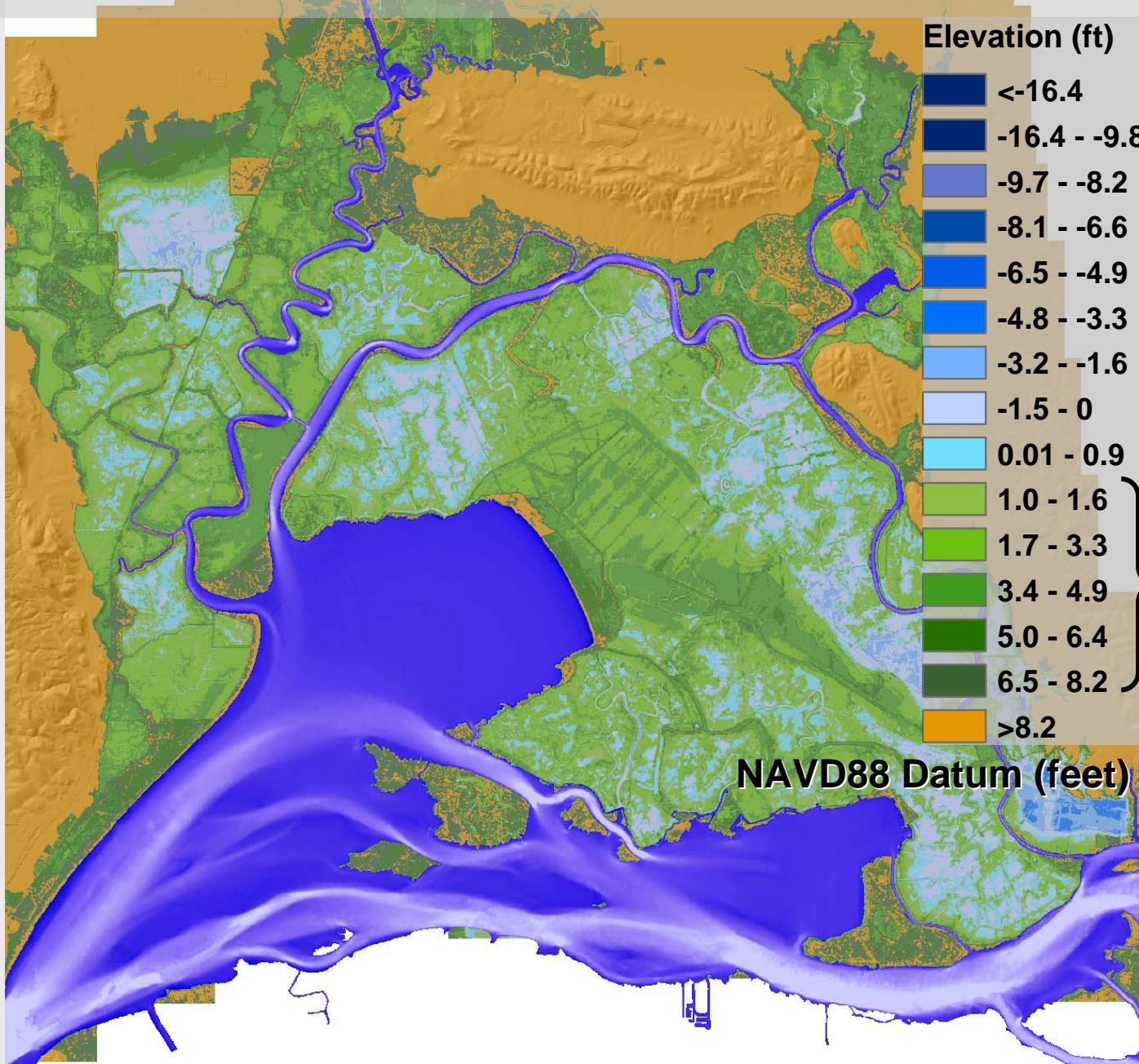


TM Restoration Site Selection



Rapid recovery
of mature
tidal marsh
function

TM Restoration Site Selection

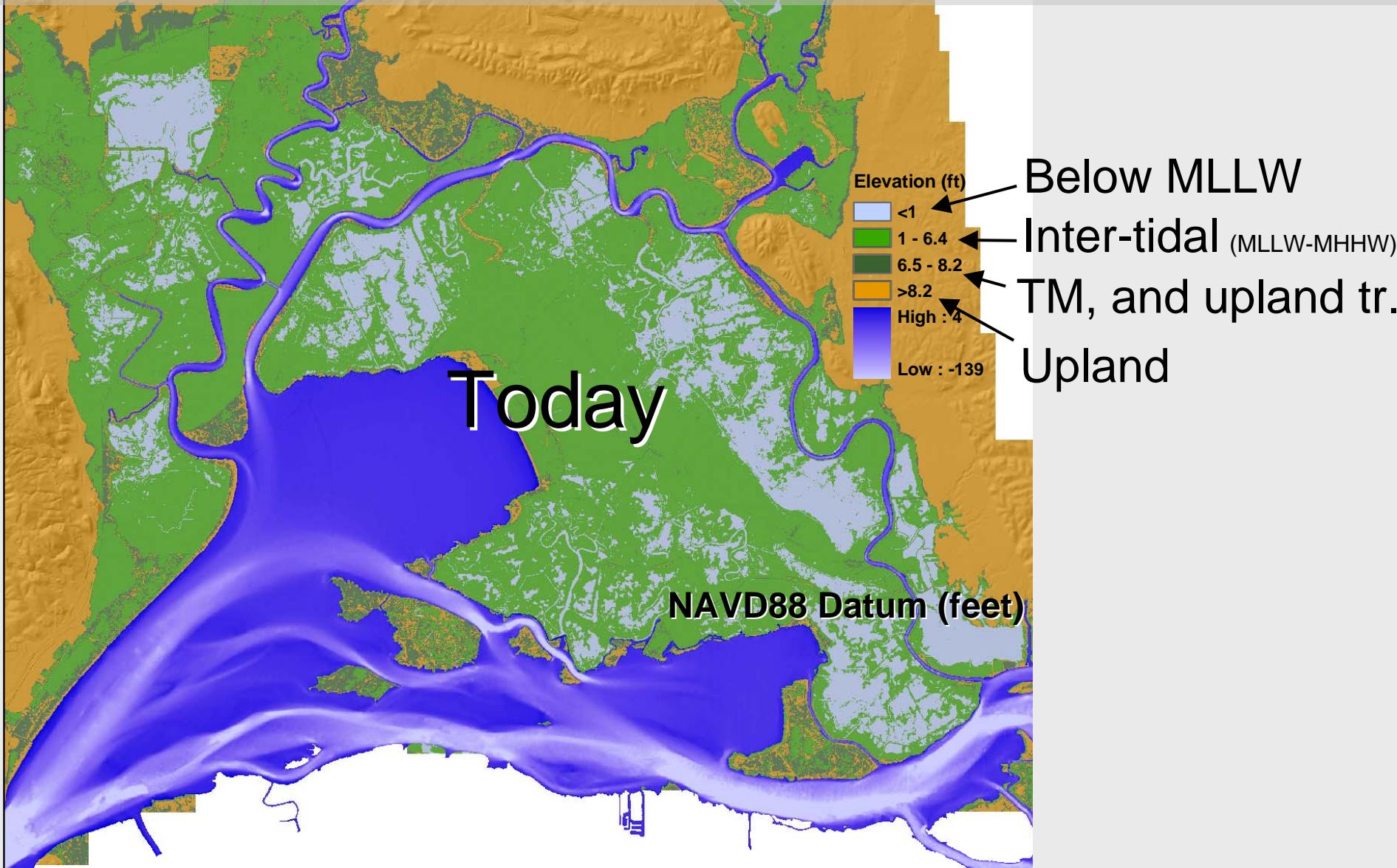


Most
vulnerable to
“going Delta”



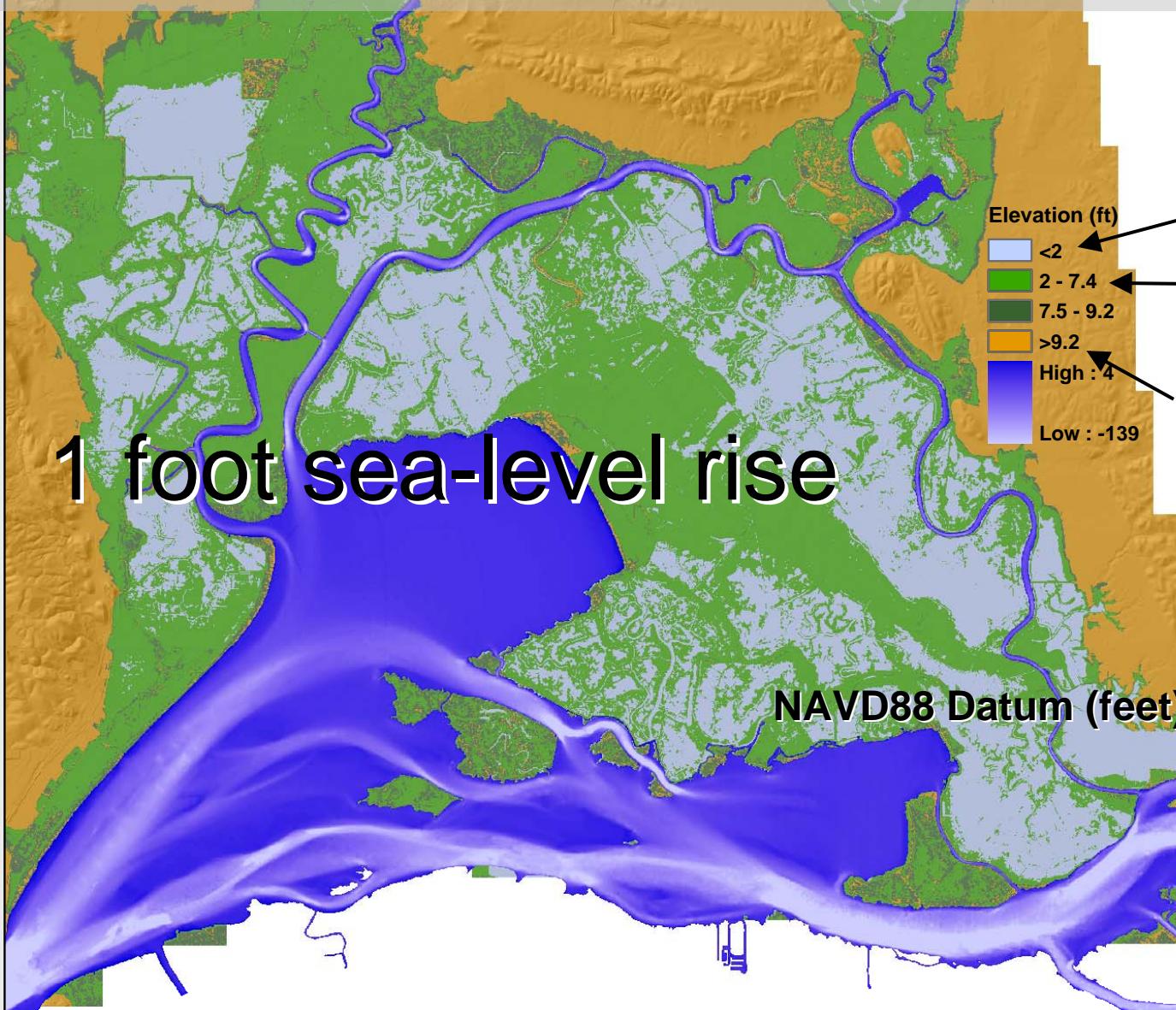
Sea Level rise

What area is below the tidal frame?



Sea Level rise

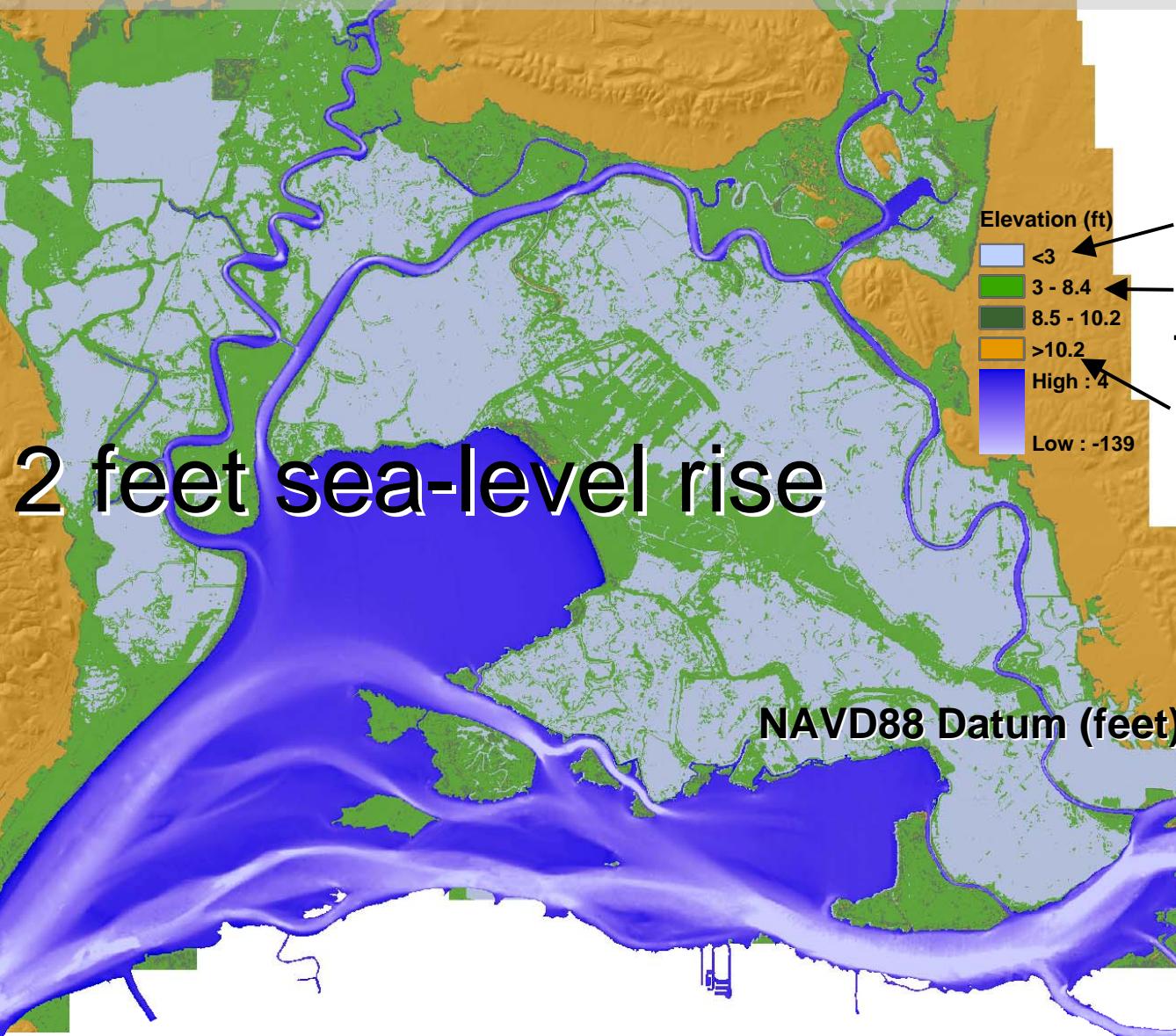
What area is below the tidal frame?



Below MLLW
Inter-tidal (MLLW-MHHW)
TM, and upland tr.
Upland

Sea Level rise

What area is below the tidal frame?



Elevation (ft)

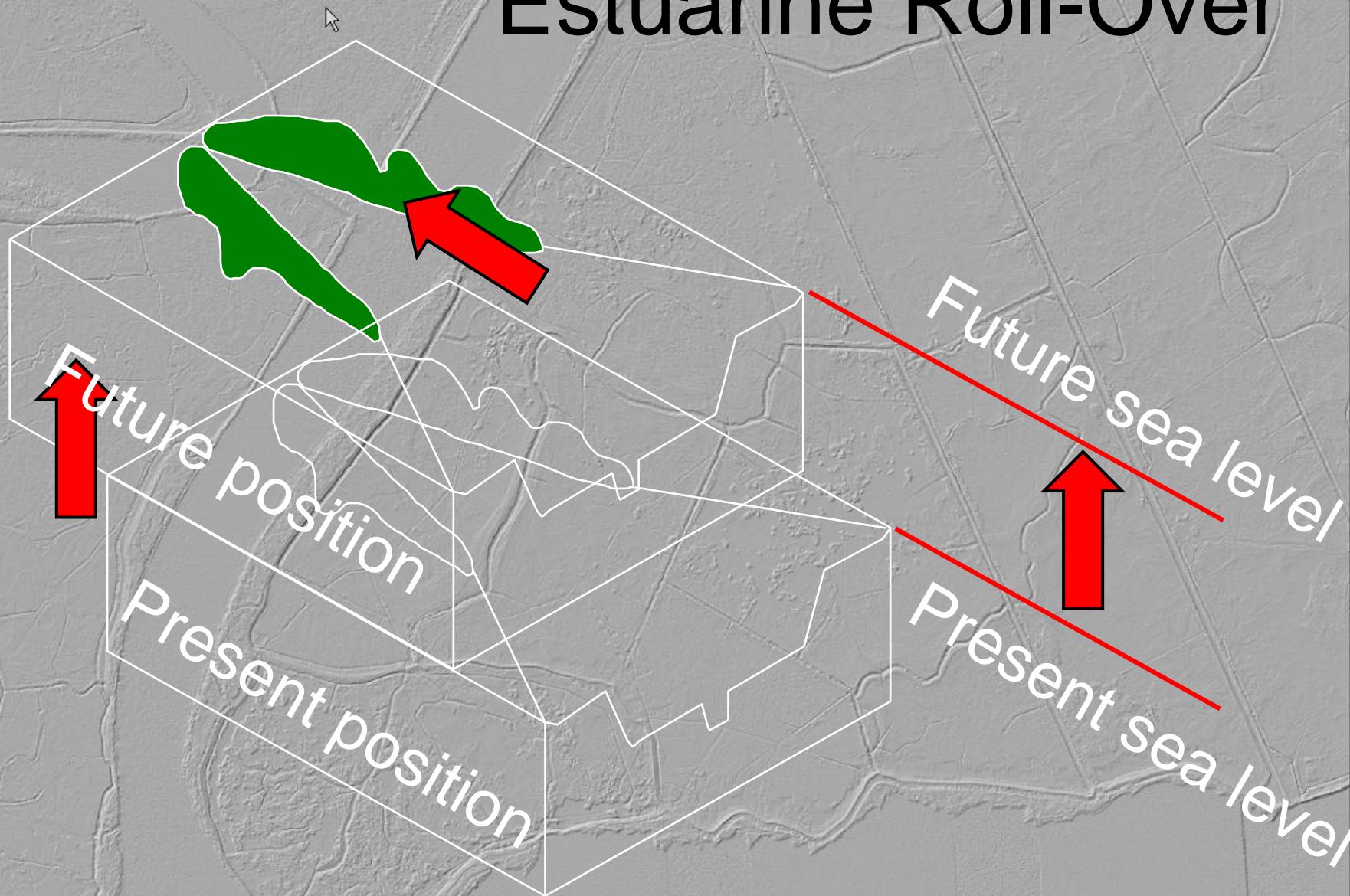
- <3
- 3 - 8.4
- 8.5 - 10.2
- >10.2
- High : 4
- Low : -139

Below MLLW
Inter-tidal (MLLW-MHHW)
TM, and upland tr.
Upland

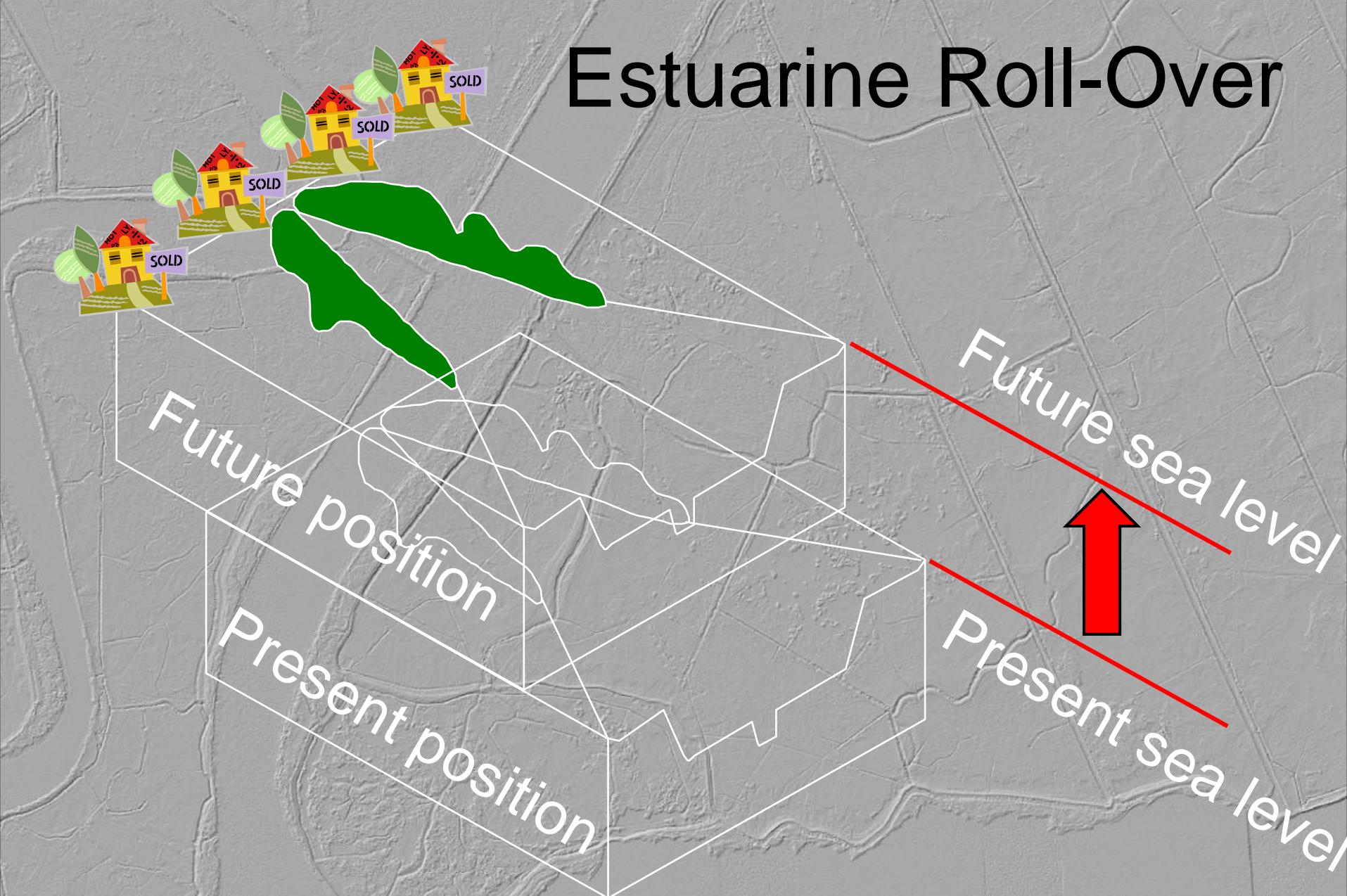
3. Where will the intertidal landscape be in the future?

- Sea level rise will require places for marshes to move uphill.

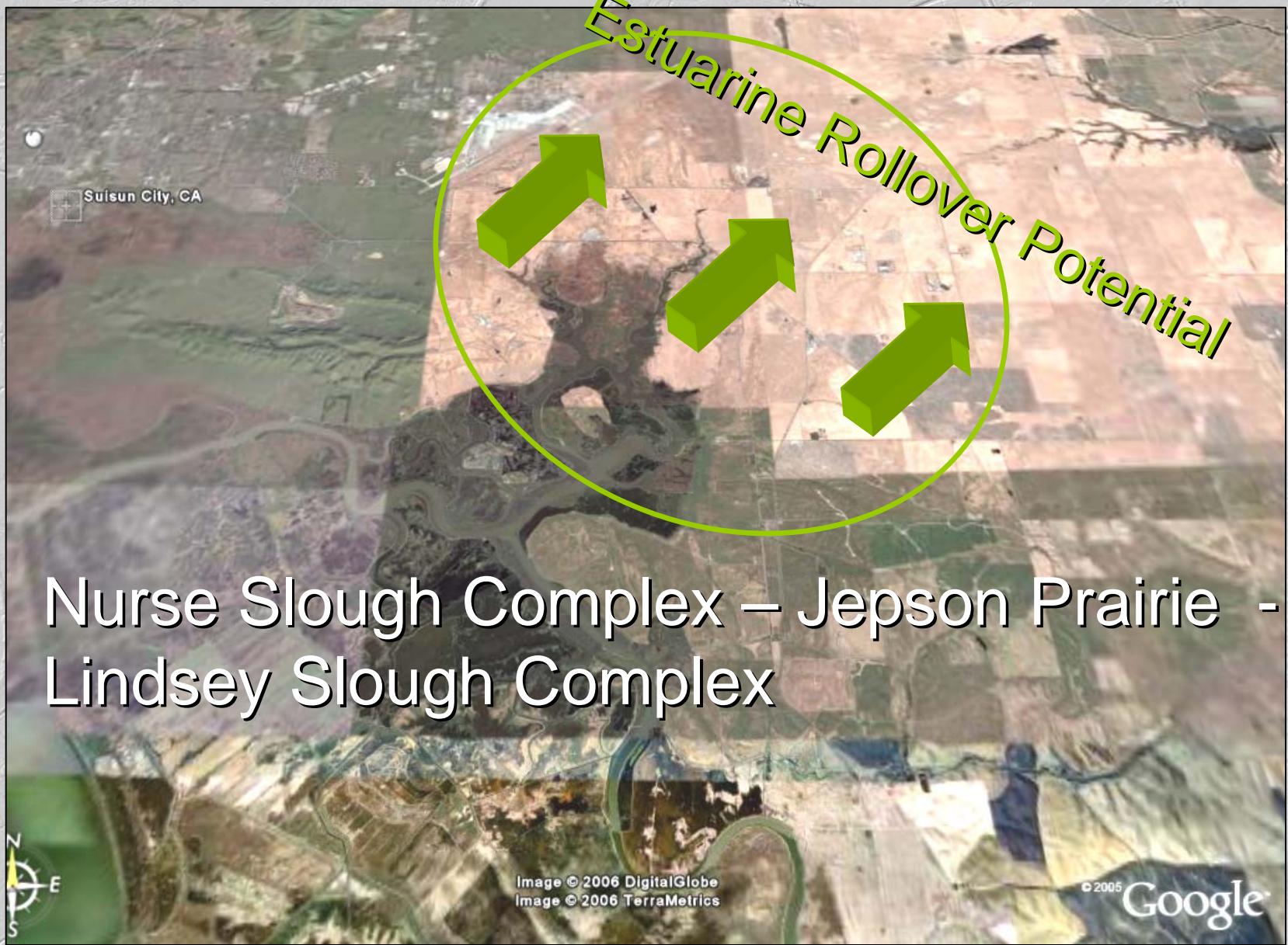
Estuarine Roll-Over



Estuarine Roll-Over



Where is Estuarine Rollover possible?



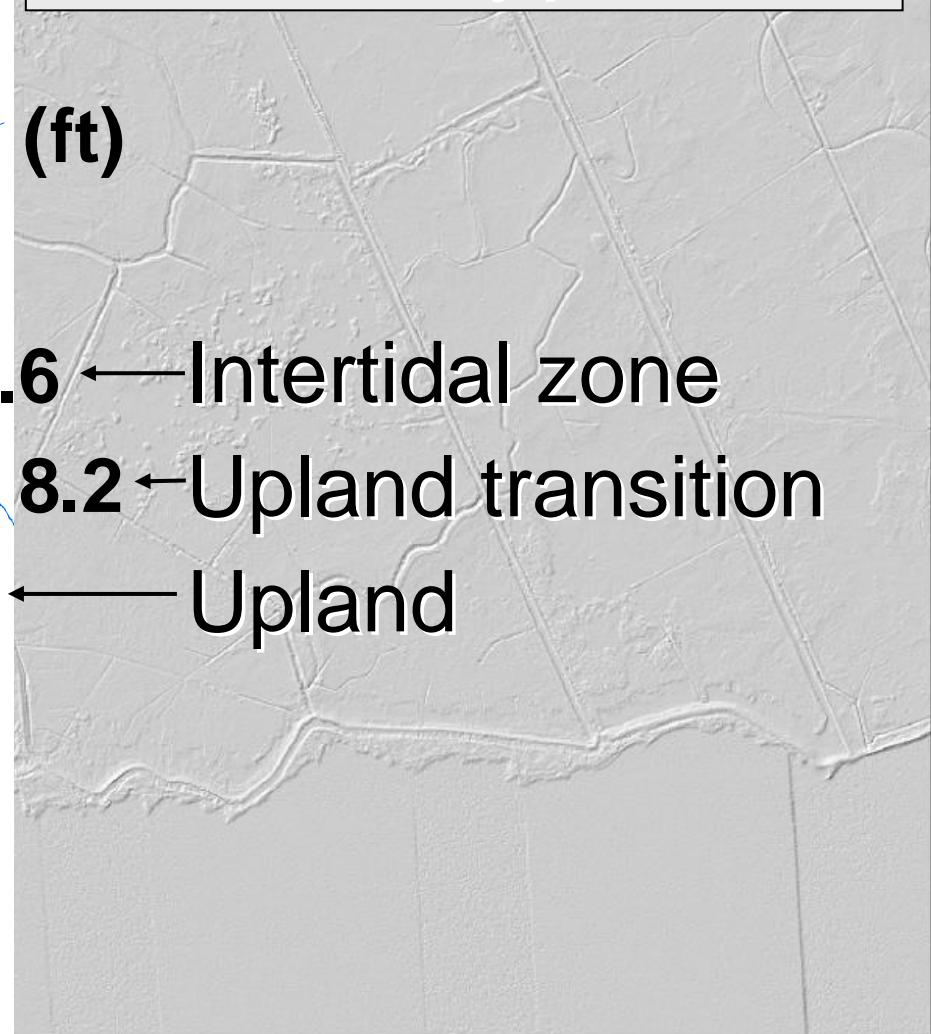
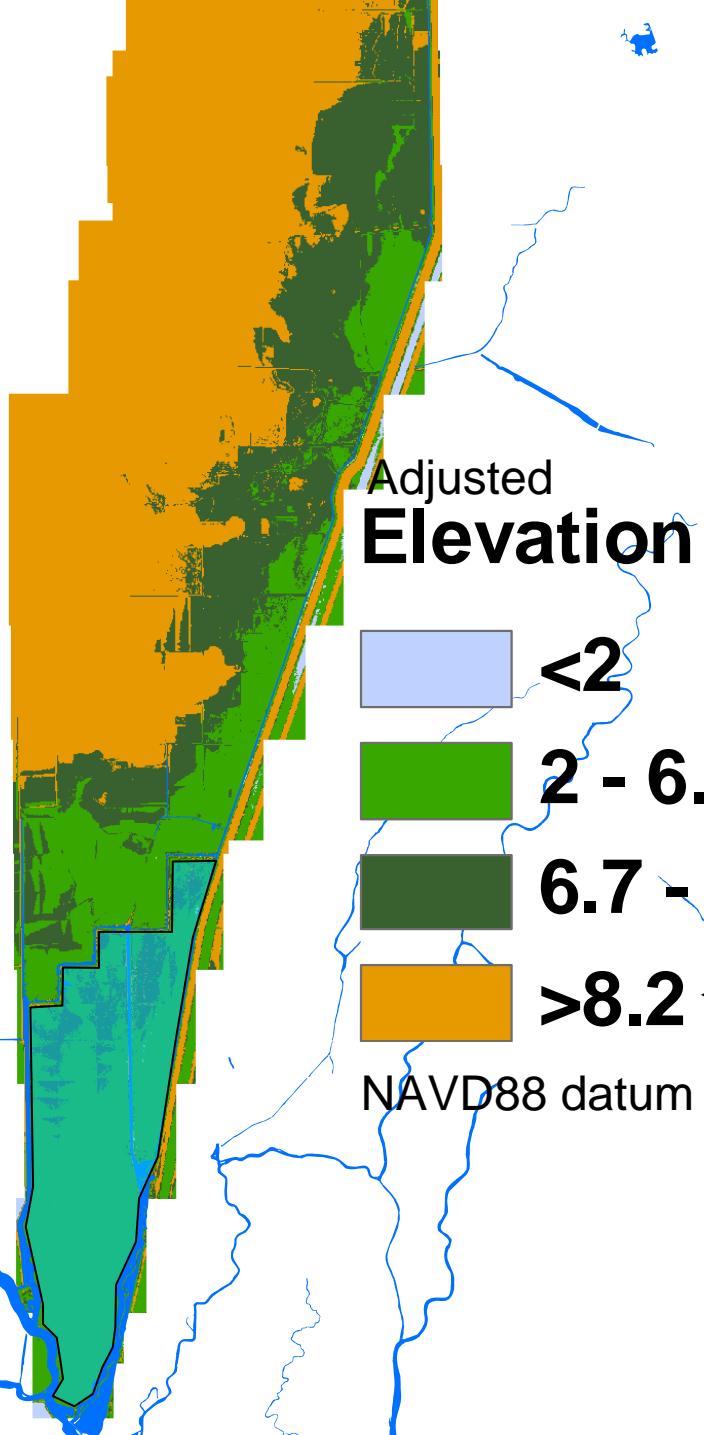
Where is Estuarine Rollover possible?



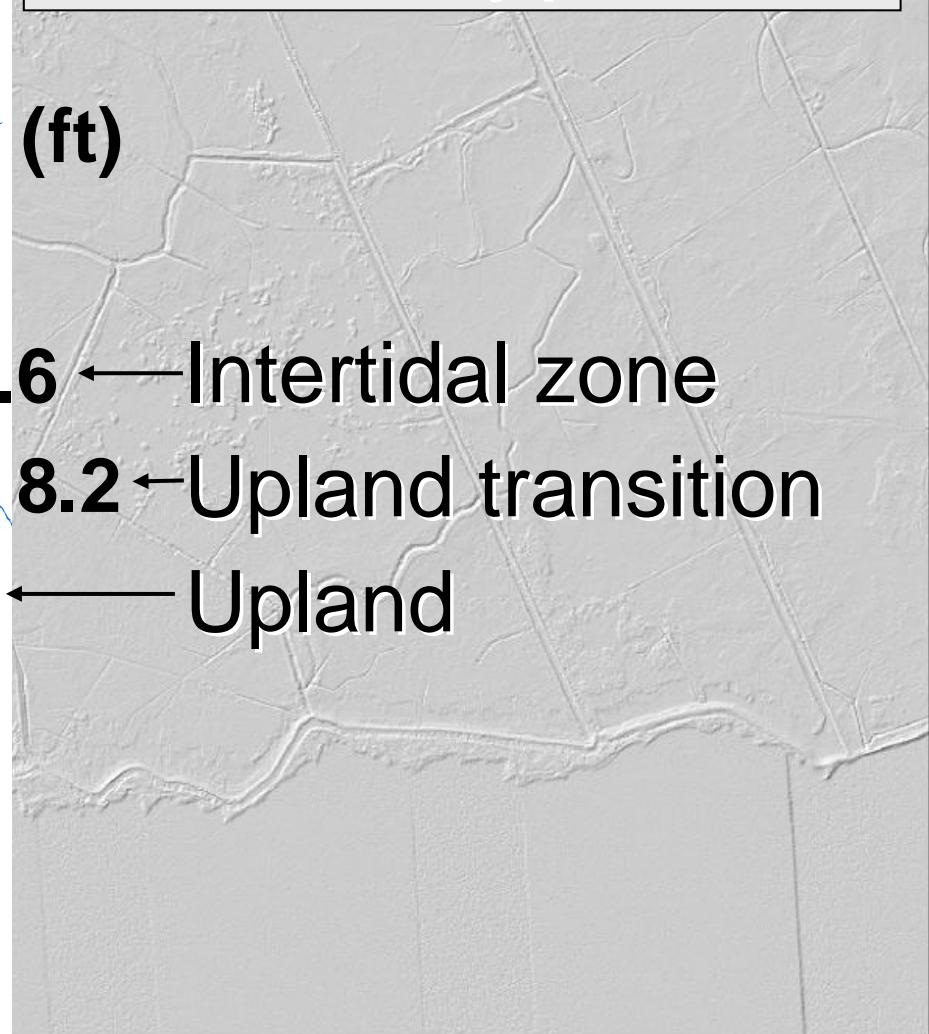
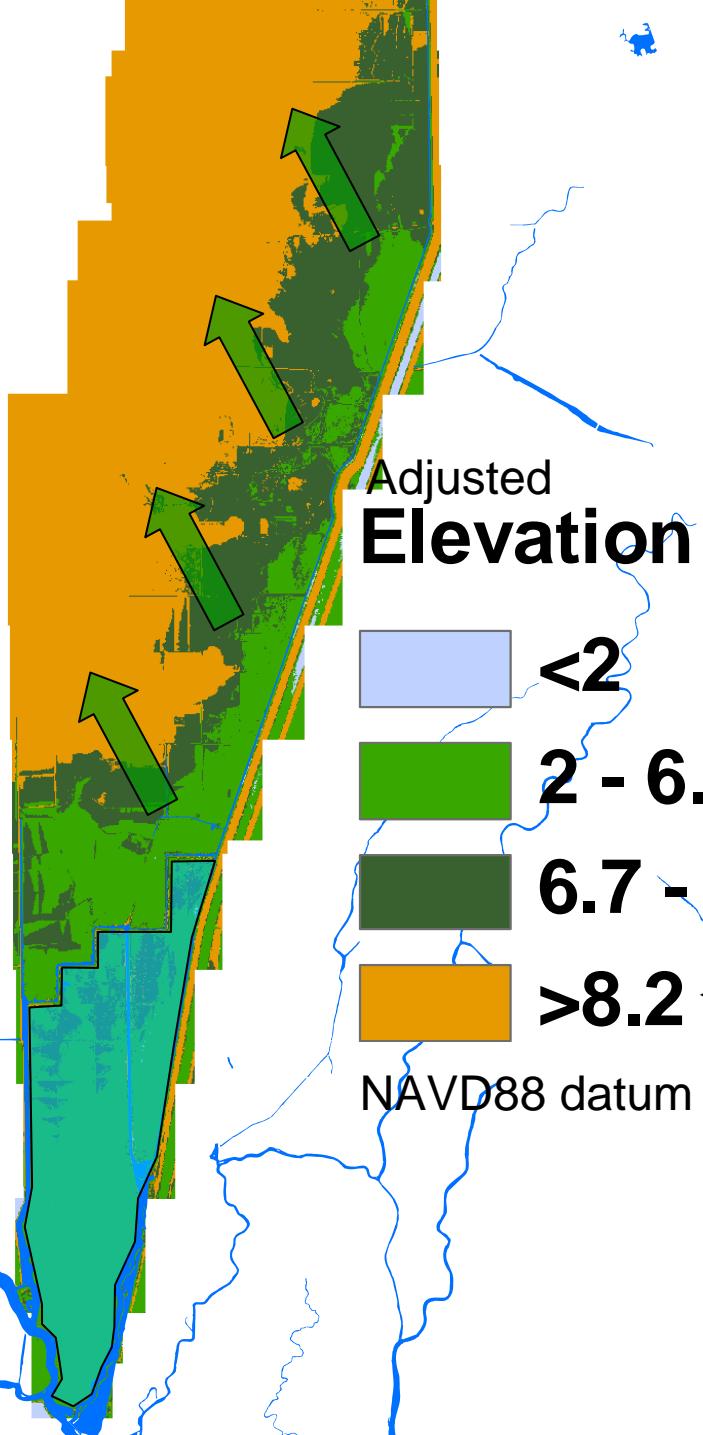
Where is Estuarine Rollover possible?



Existing intertidal elevation land in Yolo Bypass



Existing intertidal elevation land in Yolo Bypass



Summary

- Learn the lessons of Liberty Island
- Elevation is a key criteria for TM restoration. Intertidal will self-restore...
- Let's consider where tidal marshes would go with sea-level rise— protect it now.

Thank you

Xiao Wang

Joel Dudas

Victor Pacheco

Steve Culberson

Jon Burau

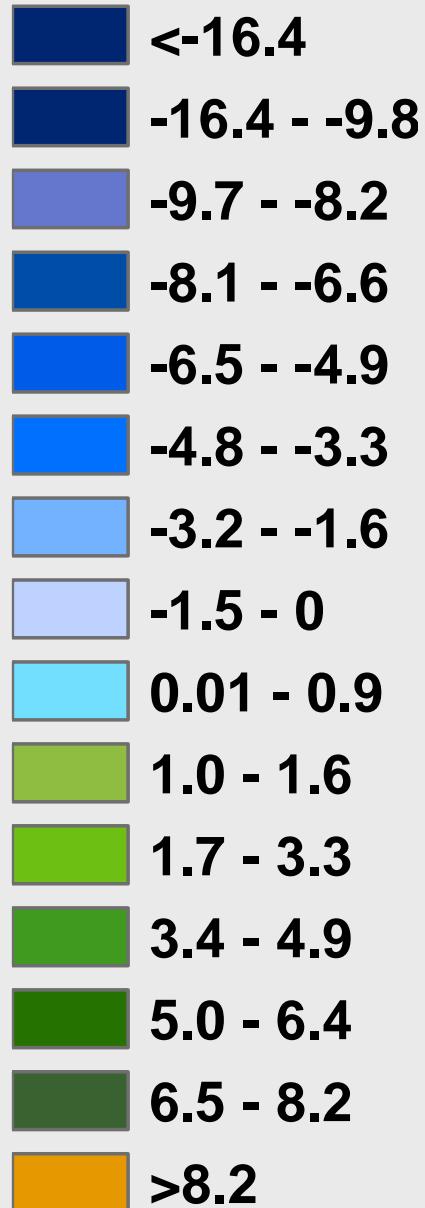
Ted Sommer

Marianne Kirkland

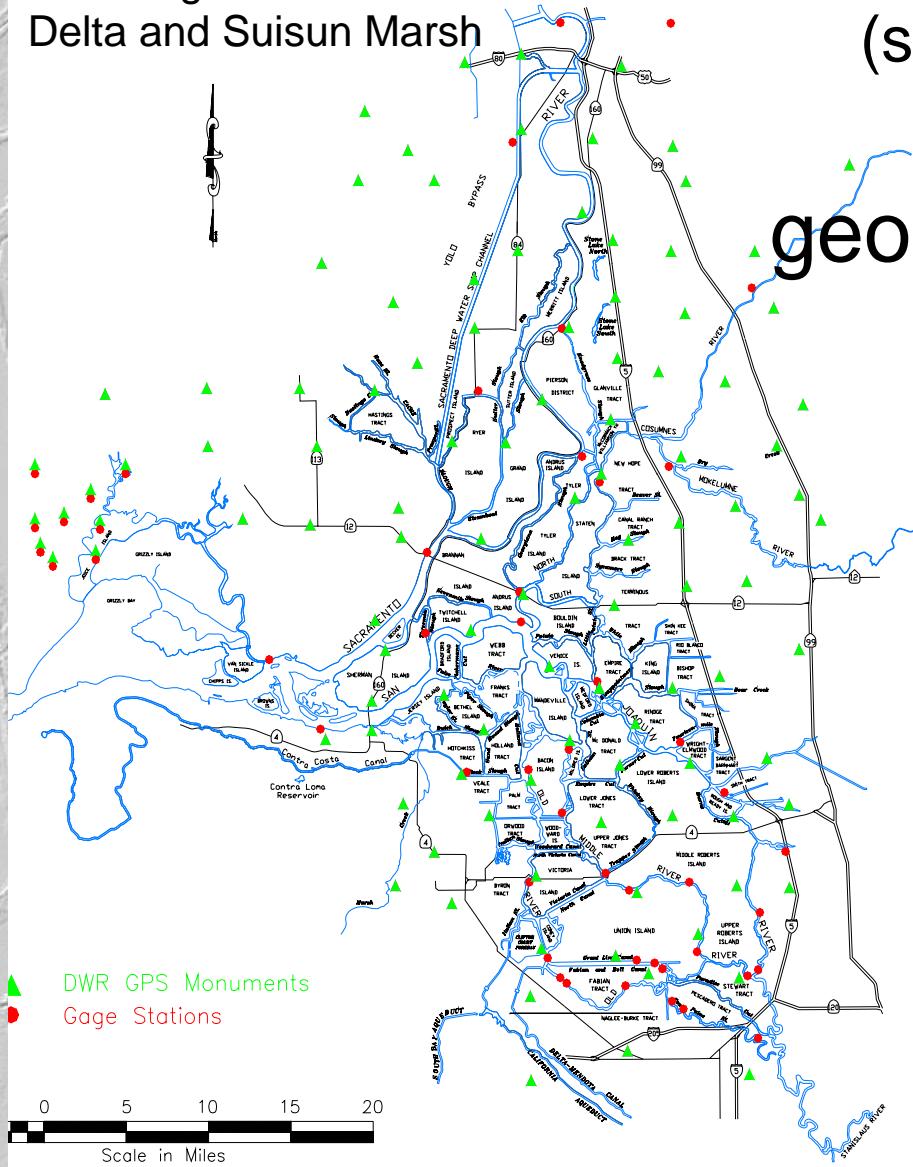
Trevor Greene

Curt Schmutte

Elevation (ft)



GPS Bench Mark and
Tide Gage Locations in the
Delta and Suisun Marsh



All elevation data
(stage, bathymetry, topography)
depends on this
geodetic benchmark network

- realigned in 2002 to NAVD88 standard
- *probably* needs to be done again soon!

Existing intertidal elevation land in Yolo Bypass

Adjusted
Elevation (ft)



<2



2 - 6.6

~ Intertidal zone



6.7 - 8.2

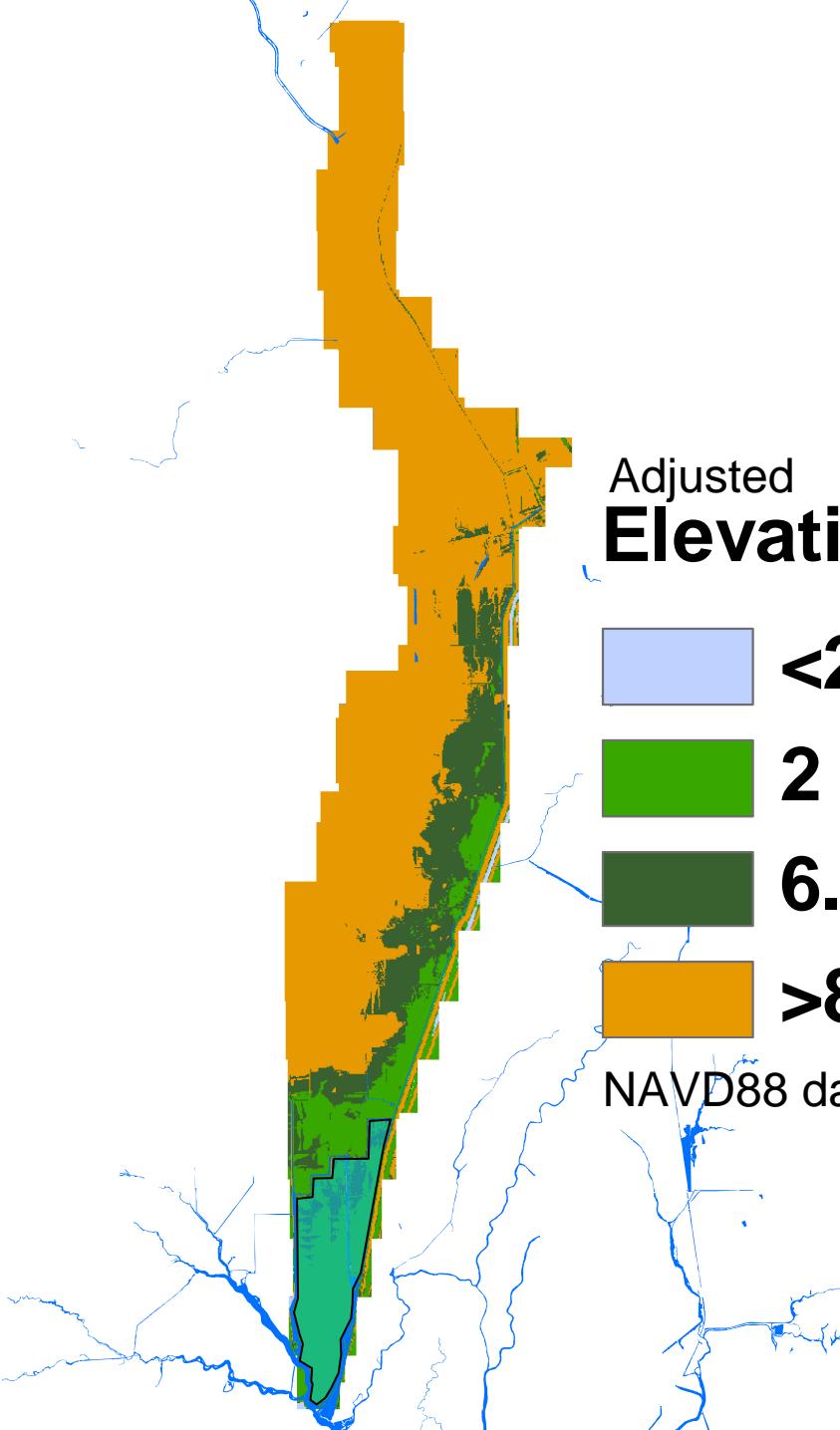
~ Upland transition



>8.2

~ Upland

NAVD88 datum



The LiDAR is generally biased high

<u>Survey site description</u>	<u># points</u>	<u>difference feet</u>
• Channel bottom	78	3.62
• Edge of ditch in water	48	3.34
• Toe	972	2.52
• Flow line	634	2.09
• Ditch Cross Section Centerline	47	2.05
• Ground shots	1766	1.74
• Top upper edge of ditch	1626	1.19
• Waterside hinge point	195	-.12
• Duck blind	30	-.68
• Levee land side hinge point	238	-.73
• Edge of concrete	7	-1.03